

1. Let J be a nonempty set, and X_i a nonempty topological space for each $i \in J$. Prove that if for some $j \in J$, X_j is not connected, then $\prod_{i \in J} X_i$ is also not connected.
2. Prove that no two of the subspaces $(0, 1)$, $(0, 1]$ and $[0, 1]$ of \mathbb{R} are homeomorphic.
Hint: what happens if you remove an end point?
3. Prove that if $n > 1$, then \mathbb{R}^n and \mathbb{R} are not homeomorphic.